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Abstract

Street vice (anonymous prostitution, gambling, and the sale of illicit drugs) is spatially concentrated, confined largely to black neighborhoods in central cities, even though demand is quite evenly distributed throughout the general population. We show how this pattern can arise through the interacting location decisions of sellers, buyers, and non-user households. Areas with high demand density (cities) have lower prices and more tightly packed sellers in equilibrium relative to areas with lower demand density (suburbs) under autarky. When trade between city and suburb is possible, competitive pressure from the city lowers suburban prices and seller density. Higher income households distance themselves from street vice, causing the exposed population to become poorer and disproportionately black. Even mild preferences over neighborhood racial composition can then induce lower income whites to exit, resulting in racial segregation. The relationship between segregation and exposure to vice can be non-monotonic and discontinuous: decreased segregation implies greater sorting by income, and hence larger wage disparities between city and suburb. If such disparities get too large, all sales can shift discontinuously to the city and result in higher overall black exposure even though more blacks now reside in the suburbs.

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1 Introduction

The extreme geographic concentration of street vice (anonymous prostitution, gambling, and the sale of illicit drugs) has been documented for over a century. In the United States, such activities are largely confined to neighborhoods that are centrally located and densely populated, with residents who have poor mobility, low reservation wages and are predominantly black. What makes this concentration remarkable is that demand for the goods and services traded in these markets is quite evenly spread by income and race throughout the general population.[1] Hence an elaborate pattern of trade exists in most metropolitan areas, with buyers converging from far-flung locations to the areas where sellers congregate.

This paper is an attempt to account for these patterns of location and trade. Any reasonably complete explanation must take into account not only the location decisions of sellers but also those of their customers and of households who are not directly involved in such transactions but may suffer in various ways from proximity to them. The correlation between neighborhood characteristics and the prevalence of street vice arises both because the characteristics attract sellers, and because the presence of sellers leads to changes in neighborhood demographics. It is this interaction that we explore, with particular emphasis on the racial dimension of sorting.

The logic underlying our analysis may be summarized as follows. Sellers in illegal vice markets tend to have high fixed costs, including scale-independent costs of protection, and therefore produce under increasing returns. Buyers have significant transportation costs, arising in part from withdrawal symptoms, risk of arrest, and the need to carry large amounts of cash or contraband. With free entry and exit of firms, areas with high demand density (central cities) have lower prices and more tightly packed sellers in equilibrium relative to areas with lower demand density (suburbs) under autarky. When trade between city and suburb is possible, competitive pressure from the city lowers suburban prices but also lowers the density of sellers. If this pressure becomes sufficiently strong, suburban sales are no longer viable at any price and all transactions move (discontinuously) to the city.

Disparities in exposure between city and suburb affect location decisions of (user and non-user) households. The user population displaces non-users in central city neighborhoods, which results in even greater demand density, lower prices, and increased seller concentration there. Higher income households distance themselves from street vice, causing the exposed population to become poorer and disproportionately black. Even mild preferences over neighborhood racial composition can then induce lower income whites to exit, resulting in extreme levels of racial segregation. The relationship between segregation and exposure is quite complex, and can be non-monotonic and discontinuous. Decreased racial segregation (due, for instance, to more integrationist preferences) implies greater sorting by income, and hence larger wage disparities between city and suburb. If such disparities get too large, all sales can shift discontinuously to the city and result in higher overall black exposure even though more blacks now reside in the suburbs. Wilson (1987, 1996) and other sociologists have perceived a deterioration in the quality of life in African-American neighborhoods accompanying increased integration since the 1960s. Our model thus provides an alternative explanation for this phenomenon.

By *street vice*, we mean illegal commercial transactions involving a willing seller and a willing

[1] See Section 2 for evidence supporting these claims.

buyer, where the seller deals with many buyers, but has ongoing relationships with few of them, and where buyer and seller must come together in close physical proximity.[2] Thus, for instance, we exclude internet pornography and pornography delivered through the mail as well as high-end call-girl operations that serve a carefully maintained list of trusted customers. We also exclude individuals who sell drugs to their friends, even if they have a large number of friends (and friends of friends). Sellers of street vice see their customers, but they don't know or trust them. Drug dealers and prostitutes who stand on street corners or in door fronts or even in vacant buildings and transact business with customers they do not know are engaged in street vice; so are numbers runners and operators of illicit but well-known gambling houses and most cock-fighting, dog-fighting and drag-racing entrepreneurs.[3]

The concentration of street vice in black neighborhoods has major welfare consequences for at least three reasons. First, there are direct effects on the surrounding community. Ludwig and Kling (2006), for instance, find that the best predictor for whether boys in the MTO experiment committed crimes was the presence of visible drug dealing in their neighborhoods. Second, the high visibility of street vice results in a greater likelihood of arrest and conviction relative to more clandestine criminal activities, exacerbating racial disparities in arrest and conviction rates (Human Rights Watch 2008, King 2008). And third, there are reasons to believe that street vice is implicated in the significant racial disparities in homicide rates. Grogger and Willis (2000), Cork (1999) and Fryer et al. (2005) all argue that drug dealing, in the form of crack cocaine, explained most of the late 1980s spike in homicide among African-Americans.[4]

Starting with location theory may also help us to understand some puzzling results about cross-metropolitan differences in young adult outcomes. Cutler and Glaeser (2000) found that young African-American adults in more segregated metropolitan areas had worse education, labor market, and marriage outcomes, with segregation measured as the index of dissimilarity. Echenique and Fryer (2007) note that these results are sensitive to the manner in which segregation is measured, and Ellen (2000) observes that centralization has a larger effect than segregation when low-birthweight is used as the dependent variable. The importance of centralization (relative to segregation) is consistent with the predictions of our model.

The relationship between crime and segregation has previously been explored in theoretical papers by Verdier and Zenou (2004) and O'Flaherty and Sethi (2007). Verdier and Zenou show that employer stereotypes of high criminality among blacks can be self-fulfilling, resulting in lower wages, diminished incentives to locate near jobs, and residential segregation. Stereotypes also play a role in O'Flaherty and Sethi (2007), but in this case it is the beliefs of robbers that whites are more compliant victims that results in higher victimization rates for whites, causing them to move to safer neighborhoods even as otherwise identical black households remain in areas with high crime. The present paper, in contrast, explores a very different process of sorting. Preferences over neighborhood racial composition play a central role in household location decisions, as in Schelling

[2] In the case of coerced prostitution, the pimp may be thought of as the willing seller.

[3] The term *vice* implies a violation of community standards—hence the illegality of these activities. We take no position on the issues of morality or illegality here.

[4] Homicide is driven in part by preemptive concerns, which implies that those who are feared are also more likely to be killed, and those who are in fear are also more likely to kill. Since the marginal penalty for murder is smaller for those who are already engaged in drug dealing, they are more likely to kill and hence also more likely to be killed preemptively (O'Flaherty and Sethi, 2008).

(1971), while providers of street vice choose locations on a one dimensional space, as in Hotelling (1929). We draw, in particular, on the location model of Salop (1979) and the segregation model of Sethi and Somanathan (2004).[5]

The paper is organized as follows. In Section 2 we survey some of the historical and statistical evidence that motivates our analysis. Drug selling is now the most significant component of street vice, and some key features of illicit drug markets are identified in Section 3. Section 4 introduces the model, and the cases of autarky and trade are analyzed in Sections 5-6 respectively, while holding constant the distribution across space of households. Residential mobility is introduced in Section 7, and the link between segregation and exposure is explored in Section 8. The location decisions of drug users are endogenized in Section 9. Some empirical implications of the model are discussed in Section 10 and Section 11 concludes.

2 Evidence

2.1 History

Writing in 1915, Booker T. Washington (pp. 113-14) described the concentration of street vice in black neighborhoods as follows:

> "A segregated Negro community is a terrible temptation to many White people. Such a community invariably provides certain types of White men with hiding-places... from decent people of their own race, from their churches and their wives and daughters... In New Orleans the legalized vice section is set in the midst of the Negro section, and near the spot where stood a Negro school and a Negro church, and near the place where the Negro orphanage now operates. Now when a Negro seeks to buy a house in a reputable street he does it not only to get police protection, lights and accommodations, but also to remove his children to a locality in which vice is not paraded."

Three decades later, Myrdal (1944, p.977) described a similar pattern:

> "Negro neighborhoods are frequented by whites who wish to do something illicit or immoral... White men come to Negro neighborhoods to find both white and Negro prostitutes. Gambling dens and cabarets (during the Prohibition era, elaborate speakeasies) are often concentrated in Negro neighborhoods... Illegal selling of narcotics is much simpler in Negro neighborhoods...Much of the crime and vice in cities, and sometimes even in smaller towns, exists because the white man brings his own crime, vice and disrespect for law to Negroes."

Long before the War on Drugs and the evolution of contemporary anonymous drug markets, it appears that street vice, especially gambling, was concentrated in African American neighborhoods.

[5] Our work is also loosely related to recent theoretical models of urban squatting (Brueckner and Selod, 2008; Turnbull, 2008) since purveyors of street vice, like squatters, use space to which they have no formal claim.

The role of the numbers game may have been especially important. This form of gambling has largely been supplanted in most states by the daily lottery, which was modeled on it. In this game, large numbers of people every day (twice a day in Chicago) place small amounts of money on particular numbers; a winning number is chosen every day and holders of that number and various permutations of it receive immediate payouts. It was called "numbers" on the East Coast, where the winning number was usually the last three digits of the daily Treasury balance, and "policy" in the Midwest, where the winning number was generally produced by a mechanical randomization device. Policy was big business. In the first half of 1935, 31.9% of male arrests in Harlem were for policy gambling (E. Franklin Frazier in a study for the Mayor's Commission on Conditions in Harlem, cited by Myrdal, p. 974). Drake and Cayton (1945, 1962), in their famous study of the south side of Chicago, devote an entire chapter to this business, which they estimate employed about 5000 people at the end of the depression (p. 481).

2.2 Arrest and Conviction Records

Arrests and convictions are not a random sample of people who engage in vice crimes; the sample is weighted heavily toward the most visible and risky (in terms of arrest) forms of vice. Street vice results in more arrests than clandestine vice for several reasons. First, neighbors are more likely to complain about it. Second, arresting street dealers is easier than arresting clandestine dealers, since street dealers will often fall victim to simple buy-and-bust operations while arresting clandestine dealers usually requires sophisticated and time-consuming infiltration efforts. To the extent that police are motivated either by complaints or by a desire to show large numbers of arrests, they will target street dealers (Stinchcombe, 1963; Goode 2002).

Surveys of drug use suggest that clandestine vice (which is much less likely to result in arrest) is a significant component of overall engagement in vice crimes. For instance, of those who used marijuana in 2006, only 43% bought it (most got it free or shared someone else's), and of those who bought it, only 16% bought it from someone they had just met or did not know well; the vast majority bought from friends (SAMHSA 2008, tables 7.41B, 7.40B). Along similar lines, Beckett (2004) estimated that in Seattle only 30% of meth users, 48% of powder cocaine users, 61% of heroin users, and 63% of crack cocaine users last purchased it outdoors. Hence a large proportion of users do not deal directly with sellers of street vice, and these clandestine transactions are not adequately captured by arrest and conviction records.

With this in mind, the records suggest that blacks have been disproportionately involved in the more dangerous, visible parts of the sale of anonymous vice for decades. Arrest data for 1940 (Uniform Crime Reports, 1940, cited in Myrdal, 1944, p. 973) indicates that blacks accounted for 22.8% of overall arrests in the US in that year. The crimes for which blacks represented the highest percentage of arrestees were liquor laws, 47.2% (distinct from drunkenness and DWI), weapons carrying (45.8%), assault (44.0%), gambling (41.9%), and criminal homicide (40.1%).

Similar patterns prevail today. On arrests, blacks are hugely disproportionately likely to be arrested for gambling: 71.8% of those arrested on gambling charges in 2006 were black (Sourcebook, table 4.10). While the proportion black among arrestees for prostitution (39.6%) and drug abuse violations (35.1%) were lower than the proportions for gambling and murder, they were still higher than the proportion of blacks among arrestees for all index crimes except robbery.

Arrest data, however, are ambiguous on whether arrestees were consumers or producers of vice; the latter is our primary concern. This ambiguity is a major concern with drug arrests, since 82% of drug arrests are for possession (Sourcebook, table 4.29), and many people arrested for possession are consumers. Data on felony convictions in state courts resolve some of the ambiguity. These are broken out by trafficking and possession: 47% of those convicted of drug trafficking offenses in 2004 were black, as were 44% of those convicted of drug possession (Sourcebook, table 5.45.2004). These proportions were higher than for any other category of crime except murder and robbery.

The disproportionate toll of drug arrests and incarcerations on the black community, especially since the start of the War on Drugs, has been well-documented (see, for instance, Human Rights Watch 2008, King 2008, Loury 2007). In 34 large US cities for which reasonably good data were available in 2003, 2221 blacks were arrested for drug law violations per 100,000 population, as opposed to 657 whites (King 2008). These arrests are also concentrated in central cities. Although only 42% of New York State's population lives in New York City, 81% of the state's drug arrests are made in the city. Blacks in New York City account for 10.7% of state population, but 42.1% of state drug arrests (King 2008). Similar results hold for state prison admissions. In 34 states for which good data were available in 2003, blacks were admitted to prison for drug offenses at a rate of 256.2 per 100,000 adult residents, whites at a rate of 25.3 per 100,000 adults (Human Rights Watch 2008).

Many reasons have been given for this disparity, including racist behavior, conscious or unconscious, in the drafting and enforcement of drug laws. Almost all commentators, however, believe that one factor in the disparity is that drugs are sold more openly in black neighborhoods than in white, in keeping with our description of street vice (Tonry 1995, Human Rights Watch 2000, MacDonald 2008, Sentencing Project 2008).[6] Hagedorn (1998), for instance, in a study of drug-selling in Milwaukee, found flourishing street drug firms in minority neighborhoods, with customers mainly drawn from outside the neighborhood, and a large percentage of white customers (p. 74). "One remarkable aspect of the white youth and suburban drug market is that, unlike the inner city, drug sales are not neighborhood-based. Try as we could, we could not locate any suburban or white, alternative culture neighborhoods that resemble inner-city drug markets like [the two minority neighborhoods]... Suburban drug selling has not changed much over the years: it still is basically a 'word-of-mouth' operation." (pp. 14-19). By contrast, Beckett et al. (2004) describe an open-air heroin market with white sellers in Seattle, but this is perfectly consistent with our model. Indeed, in a situation with a large white population living at fairly high density and a small black population, one would expect to see street vice in white neighborhoods. We have been unable to locate any ethnographic reports of black customers traveling to white neighborhoods to purchase drugs.

2.3 Drug Demand

Non-Hispanic blacks use illicit drugs somewhat more frequently than non-Hispanic whites do, and non-Hispanic whites use drugs more frequently than Hispanics do, but the differences, while statistically significant, are small. Table 1 provides details (SAMHSA, 2008, tables 1.19B and 1.19D).

[6] Beckett (2004) and Beckett, Nyrop and Pflingst (2006) argue that in Seattle open-air sales are not the major factor in the disparity, but concede that they are still a factor.

Differences in drug use by race and ethnicity are clearly far too small to account for the disparities in arrest and conviction rates. The only major difference arises in the case of crack cocaine, but this is a very small component of overall illicit drug use. In the case of powder cocaine, non-Hispanic whites had a higher rate of use than non-Hispanic blacks in 2006, and the overall incidence of cocaine use (powder and crack combined) was virtually identical.

Table 1. Percentage over 12 who had used illicit drugs in the past month.

	White	Black	Hispanic
Illicit Drugs	8.3	9.8	6.9
Marijuana	6.4	7.4	4.1
Powder Cocaine	0.9	0.3	1.4
Crack Cocaine	0.2	0.8	0.3

Source: 2006 National Household Survey of Drug Use and Health

3 Features of Illicit Drug Markets

We draw on several features of illicit drug markets to motivate our modeling assumptions. Many (but not all) of these apply more generally to markets for anonymous vice. In an earlier era (for instance, during the ascendancy of the numbers game as described in Drake and Cayton), we might use language about some other form of street vice but in keeping with the current situation, we concentrate on illicit drugs.

First, customers have high transportation cost. On trips to the market, many will be experiencing or fearing withdrawal symptoms, and will otherwise be desperate and anxious. Time searching for a sofa to buy is usually more pleasant than time searching for heroin to buy. On return trips with drugs, customers will be subject to arrest by police and drug confiscation; they may also be preyed upon by free-lance robbers. Because home storage of drugs is dangerous, users will make frequent trips. Poor users, moreover, may rely on public transportation, but cannot confine their trips to rush hours when service is frequent.

Second, drug sellers have high fixed costs. Because their activities are illegal, they have a high cost of protection regardless of their scale, since they must employ some means of fending off both authorities and those rivals who would disrupt their business or steal their cash and inventory. If firms did not have high fixed costs, high transportation costs for customers would imply that many small firms would spread evenly throughout the metropolitan area to accommodate customers directly. Every neighborhood would have a convenient drug dealer, just as every neighborhood now has a convenient place to pick up a lottery ticket or a quart of milk.

Third, demand almost everywhere is quite thin. Less than $\frac{1}{2}\%$ of gross domestic product is spent on illicit drugs, and well over 95% of the population never buys them. Because demand is thin relative to fixed costs, not every neighborhood can support its own free-standing drug dealer.

Fourth, drug dealing firms specialize; you generally cannot sell illicit drugs along with brooms, furniture, milk, shoes, and birthday cards. This is because drug dealing is illegal: by selling drugs you put your birthday card inventory at risk of being confiscated or stolen, and so you will not be the lowest-cost seller of birthday cards. Thus illicit drug dealers cannot imitate CVS or Walmart and spread their high fixed costs over many products, each of which individually has thin demand.

Fifth, drug dealing uses unskilled labor intensively. Selling itself requires little more than inventory and unskilled youths, and the fixed costs of protection are also provided primarily by hoodlums who have few other marketable skills. All wages must be augmented by a premium to offset the risk of imprisonment, but that premium depends on the reservation wage of labor. Studies of street-level drug selling having found that many people engage in it for short periods of time, often while they have other jobs or commitments (Reuter and MacCoun 1992, Reuter, MacCoun and Murphy 1990, Levitt and Venkatesh 2000). There is also a consensus that drug dealing pays better than the wages its workers could otherwise command, but disagreement on the size of the premium and whether it is reasonable compensation for the risks involved. Ethnographic studies (Bourgois 1995) and studies using business records (Levitt and Venkatesh 2000) find smaller premiums than studies that rely on self-reports (Fagan 1992, Reuter and MacCoun 1992). Caulkins et al. (1999) emphasize the heterogeneity of jobs and firm organization in this market, and this heterogeneity may explain the differing findings.

Sixth, workers in this industry usually do not make long journeys to work from their homes. To the extent that they must carry drugs or money before or after work, long journeys are dangerous. Those selling drugs on street corners cannot lock up their inventory and money in a handy safe when the time comes to go home. Even for those workers without these responsibilities, being local has great advantages, since knowledge of a neighborhood's idiosyncrasies, both geographic and human, can be crucial for handling law enforcement, robbers, and rivals.

Finally, street dealers don't pay for the space they use. Therefore they do not have to outbid competing users, and can operate at their ideal locations. The price of land does not enter their calculus (although drug dealing manifestly can affect the price of land). They do, however, have to make defensive expenditures to maintain their use of the land, as in Brueckner and Selod (2008); we model these expenditures explicitly.

These seven features of illicit drug markets generally imply that drug dealing will be concentrated in centralized, low-wage neighborhoods, although the degree of concentration depends on many specific parameters. These intuitions, however, do not account for the possibility of consumer (and non-user) mobility. If drug consumers were fully mobile, and cared about nothing else, they would all live in the same place, and drug dealing would be incredibly concentrated, but it would not necessarily be centralized. The drug community would locate where wage costs were lowest. Similarly, if non-users were indifferent to the presence of drug dealers the demographic characteristics of the population exposed to street vice would not necessarily differ greatly from those of the population at large.

Neither of these is the case. Drug-selling causes many kinds of indirect harm in the neighborhoods where it occurs: teenagers are more likely to engage in non-drug crime of all sorts, to drop out of school, to eschew the legal workplace and the behaviors it rewards; older people are more likely to be endangered when they use the streets; legitimate businesses have difficulty protecting their inventory and customers; parks and open spaces become dirty, dangerous, and uninviting. Most residents will therefore seek out other places to live, and those who remain will be the ones who are least willing and able to pay the higher rents that characterize safer and more appealing environments.

Responding to these significant disamenities, the most affluent non-user households will tend to leave neighborhoods where drug dealing starts to be "openly paraded", and the exposed population will therefore be of lower income. Racial disparities in the metropolitan distribution of income then imply that the exposed population will have a higher share of black households than the population at large. This in turn induces whites to outbid blacks of equal affluence for housing in safer neighborhoods, even if preferences over neighborhood racial composition are moderately pro-integrationist and reflect a taste for diversity. The result is even greater segregation by race than sorting based on income alone would predict. Similar effects arise in the user population: black users are more likely to reside in neighborhoods with extensive street vice than white users of similar income.

There are other factors which induce whites to leave even as blacks in the same income class remain. Market sorting ensures that those who remain will be less averse to the disamenities drug dealing creates. In particular, ceteris paribus, they are the people who would feel safest in such a dangerous neighborhood. White people are less likely to feel safe in a black, drug-dealing neighborhood for a variety of reasons: because they are likely to be stereotyped as drug consumers (correctly, since a higher proportion of whites than of blacks seen in these neighborhoods are buying drugs), because they are likely to be stereotyped as non-resistant, possibly because they are stereotyped as rich, and because they are likely to be stereotyped as having few relatives or close friends in the neighborhood to avenge crimes against them. Simple prejudice may also be operative. Since whites will not outbid blacks to live in these neighborhoods, they will remain predominantly black, despite the disamenities.

Indeed, the long-run residential dynamics of drug-dealing neighborhoods are stable. Drug consumers move in, African Americans of various income levels and the poorest of whites remain, and all others move out. The more poor people, the lower the wage that drug-dealing firms have to pay. And the greater the demand density, the lower the equilibrium price and inter-seller distance. These dynamics are explored more fully below.

4 The Model

We model a metropolitan area as two concentric circles (city and suburb), with the city having circumference L_c and the suburb circumference $L_s > L_c$. Total demand for drugs per unit population is assumed to be price inelastic.[7] The demand per unit distance in neighborhood (city or suburb) $i \in \{c, s\}$ is denoted ρ_i, and we assume that $\rho_c > \rho_s$ (demand density is greater in the city than in the suburb). Note that this does *not* require that per-capita demand is greater in the city; it is enough that the city have greater population density. The condition $\rho_c > \rho_s$ would hold even if both city and suburban residents consume drugs at the same rate, simply because the former live in closer proximity to each other. Greater population density in central neighborhoods is a standard theoretical result in urban economics that has considerable empirical support (see, for instance, Mieszkowski and Mills, 1993).

All travel is along the circumference of the circle on which an individual resides, except possibly

[7] Inelastic demand, at least up to some high choke point, is the usual assumption in spatial competition models (Hotelling 1929, Salop 1979). In addition, Becker, Murphy, and Grossman (2005) conclude that substantial evidence supports the proposition that illicit drug demand is inelastic.

for some travel between circles, which we introduce in Section 6. Within one's neighborhood consumers have (linear) travel cost per unit of distance of t. (We assume for simplicity that this is the same in both locations, although all results continue to hold as long as the travel cost per unit distance in the city and suburb are not too different.)

Consumers minimize the total cost of acquiring drugs, which is simply the sum of travel cost and the price paid. Let $|y_1, y_2|$ denote the distance between points y_1 and y_2 on the same circle i. Then a consumer at point y, confronted by a set of firms with prices p_j and locations y_j, will purchase drugs from firm j^* where

$$j^* = \arg\min_j \; p_j + t\,|y, y_j|\,,$$

and will be indifferent about purchasing from a set of firms that minimize this expression.

Drug entrepreneurs make three decisions: whether to operate, where to operate, and what price to charge. To operate their businesses in neighborhood $i \in \{c, s\}$, they must pay a fixed cost C, and hire one unit of labor at wage w_i per unit of drugs sold.[8] The fixed cost includes defensive payments, as used in Brueckner and Selod (2008), and the wage w_i includes the wholesale price of drugs. Following Salop (1979), all firms who decide to enter a neighborhood are assigned locations on the circle equidistant from each other. We are more interested in the division of business between neighborhoods than in the exact location of firms within neighborhoods.

There are a large number of potential firms. We model their interdependent decision-making as a two-stage game. In the first stage, each firm decides whether to enter, and if it enters, which neighborhood to locate in. In the second stage firms set prices. We look for subgame perfect equilibria of this two-stage game. Since there are many identical potential firms and many identical locations, in equilibrium all firms that enter will make zero profit (we ignore the constraint that the number of firms be an integer). This approach is standard in Salop (1979) and the ensuing literature.

A firm charges the same price to all its customers. Labor is supplied perfectly elastically at the going wage w_i in each neighborhood i. At that wage, a firm can hire as many workers as it wants from the exact location of its business (workers do not commute). The assumption of perfect local supply elasticity reflects the fact that drug-selling requires few specific skills, and that it is a small industry.

5 Autarky

We assume first that travel between the two neighborhoods is impossible; this assumption is relaxed in the next section. In this case we can find the equilibrium on each circle separately. The solution is standard (Salop 1979, Tirole 1989 section 7.1.2). Define

$$A_i = \frac{C}{t\rho_i}. \tag{1}$$

[8] As in the case of the travel cost t, we assume for notational simplicity that the fixed cost is independent of location. All our results continue to hold with heterogeneous fixed costs as long as fixed costs are lower in whichever location has lower wages. This is plausible, since a major component of fixed costs involves the hiring of unskilled labor for protection. The costs of protection tend to be lower in less affluent areas both because the market wage is lower, and because authorities are less steadfast in their opposition to street vice.

Suppose that n_i firms enter neighborhood i in the first stage, and are located at a distance $\delta_i = L_i/n_i$ from their nearest neighbors. Consider a firm that charges a price q when all other firms charge p. The marginal consumer (indifferent between this firm and its neighbor) will be at a distance s from this firm, where $q + ts = p + t(\delta_i - s)$. Hence

$$2s = \frac{p-q}{t} + \delta_i.$$

The firm's profit is then

$$2s\rho_i (q - w_i) - C = \rho_i (q - w_i) \left(\frac{p-q}{t} + \delta_i \right) - C.$$

The first order condition is (after simplification)

$$2q = p + t\delta_i + w_i.$$

At a symmetric Nash equilibrium $q = p$ so

$$p_i = t\delta_i + w_i. \quad (2)$$

The number of firms entering at the first stage is determined by the zero profit condition, with full anticipation of second stage prices:

$$(p_i - w_i)\rho_i\delta_i - C = 0.$$

This, together with (1) and (2), implies

$$\delta_i = \sqrt{A_i} \quad (3)$$

and the equilibrium number of firms is

$$n_i = \frac{L_i}{\sqrt{A_i}}. \quad (4)$$

From (2), the price charged in neighborhood i can be expressed in terms of the primitives of the model as follows:

$$p_i = w_i + t\sqrt{A_i}. \quad (5)$$

Suppose for the moment that wages are identical across neighborhoods. Then, since $\rho_c > \rho_s$, we have $A_c < A_s$ and hence $p_c < p_s$. Drug prices will be lower in the city than in the suburb because demand density is greater, promotes more competition and allows fixed costs to be spread over a large base without requiring large travel costs. Furthermore, we have $\delta_c < \delta_s$, so firms will be located closer to each other in the city. This is because greater density allows more demand to be generated in a small space. We cannot say whether there are more firms in the city than in the suburb, because the geographic expanse of the suburb is greater.

This basic conclusion (lower prices and shorter distance between firms) is further strengthened if wages are lower in the city than in the suburb. This follows immediately from (1–3), and we state the result for future reference as

Proposition 1. *If $w_c \leq w_s$ then $p_c < p_s$ and $\delta_c < \delta_s$.*

Wages may be lower in the city if less affluent households live there, which itself could be an equilibrium response to higher levels of drug-selling activity. We argue below that the conditions under which Proposition 1 holds will be satisfied even when location choices of users and non-user households are fully endogenous.

It is useful to compare the two neighborhoods on the basis of the per-capita number of firms, given by

$$\frac{n_i}{\rho_i L_i} = \sqrt{\frac{t}{\rho_i C}}.$$

Thus, in autarky, although drug firms are easier to find in cities, city residents are not disproportionately employed in the industry.

6 Trade

Since prices in the city are lower in autarky, and drug firms are easier to find, there is scope for trade. In this section we examine trade driven by price differences, and in the next section we add household mobility. Since city residents have no reason to go to the suburbs to buy drugs, we look only at whether suburban consumers will buy drugs in the city.

We assume a simple technology for inter-neighborhood trade. A suburban consumer who wants to buy drugs in the city must pay a (round-trip) cost τ which delivers him from his home location to a randomly selected location in the city.[9] Once in the city, the consumer behaves exactly as a city resident would, paying additional travel costs to reach a firm, and selecting the firm which minimizes total cost (inclusive of travel). Given any symmetric equilibrium in which the city price is p_c and the inter-firm distance in the city is δ_c, the expected cost of drugs to suburban consumers who buy in the city is simply

$$\pi = p_c + \tau + \frac{1}{4}\delta_c t. \tag{6}$$

This serves as a reservation price for suburban consumers. Note that under autarky, using (5) and (3), we have

$$\pi_{aut} = w_c + \tau + \frac{5}{4}t\sqrt{A_c} \tag{7}$$

Three distinct classes of equilibria can arise when trade is possible. When τ is sufficiently large, the autarky equilibrium is replicated and there is no effect on prices or the number of firms in either neighborhood. For somewhat smaller values of τ, the possibility of trade exerts competitive pressure on suburban sellers, who are forced to lower prices in order to retain their customers. Lower suburban prices result in the exit of some firms, so inter-firm distance in the suburb increases. There is no effect on prices of the number of firms in the city, and no trade actually occurs. Finally, if τ is sufficiently small, there exists an equilibrium in which all suburban consumers buy from city firms, prices in the city fall, and entry raises the number of sellers in the city. The latter two types of equilibria can coexist, and indeed must do so for certain values of τ. Stated formally, we have:

[9] The value of τ reflects time as well as the dangers that might be perceived from travelling in a strange neighborhood on an illegal mission with considerable money. On the other hand, as Booker T. Washington pointed out, leaving one's home neighborhood to shop for drugs has some advantages, which may mitigate some of these costs.

Proposition 2. *There exist thresholds τ_l, τ_m, and τ_h such that $\tau_l < \min\{\tau_m, \tau_h\}$ and (i) if $\tau > \tau_h$ there is an equilibrium with no trade and no impact on prices or seller density relative to autarky, (ii) if $\tau_l < \tau < \tau_h$ there is an equilibrium with no trade in which the suburban price and seller density are both lower relative to autarky, and (iii) if $\tau < \tau_m$ there is an equilibrium in which all suburban consumers buy in the city, which has greater seller density and lower prices relative to autarky.*

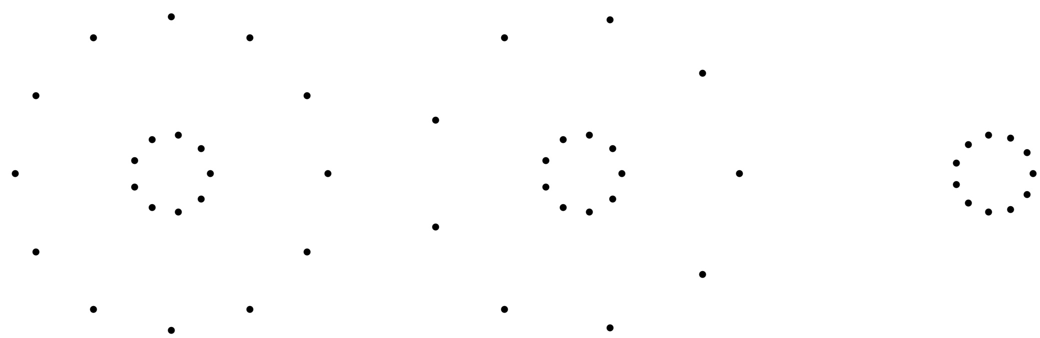

Figure 1. Geographic distribution of firms in the three regimes.

The number and spatial distribution of firms in each of the three regimes are shown in Figure 1 for a particular specification of the model.[10] As the cost to suburban residents of purchases in the city decline from a high level, the initial effect is to lower the number of suburban firms and increase the distance between them. This transition is continuous. Eventually a point is reached when suburban sales can no longer be supported, and there is a discontinuous transition to the agglomeration regime, with a sharp rise in the number of firms in the city. The changes in the suburban drug price corresponding to this transition are shown in Figure 2 (the transitions occur as one moves from right to left). Note that the transition to a centralized structure can occur at any value of τ between τ_m and τ_l, consistent with the fact that there are multiple equilibria in this range.[11]

When τ lies in the range $\tau_l \leq \tau \leq \tau_h$, lower values of τ correspond to lower suburban drug prices, fewer suburban firms, and greater distance between firms. Intuitively, competition from the city forces suburban firms to cut prices; lower prices put some firms out of business; fewer firms mean greater distances between firms. All suburban consumers continue to buy in the suburbs: the marginal consumer faces greater transportation costs since firms are harder to find, but these costs are exactly offset by lower prices. In this regime, the most visible difference between city and

[10] The figure is based on the following parameters: $L_s = 12$, $L_c = 3$, $\rho_s = 1$, $\rho_c = 9$, $F_s = F_c = 1$, $t_s = t_c = 1$, and $w_s = w_c = 1$. The number and neighborhood location of firms in each of the three equilibria shown are $(n_s, n_c) = (12, 9)$ in the first regime, $(n_s, n_c) = (9, 9)$ in the second, and $(n_s, n_c) = (0, 11)$ in the third.

[11] Note also that it is theoretically possible for τ_m to exceed τ_h, in which case multiple equilibria will arise even when $\tau > \tau_h$. For this to occur, aggregate suburban demand must be sufficiently large relative to the internal demand in the city.

suburb that we found in autarky is magnified. Drug firms are even further apart in the suburb than they were in autarky, but they are just as close together in the city. For strong enough competition, this process can unravel: price cutting leads to fewer firms, which leads to less accessibility, which leads to lower prices in order to keep customers from defecting. When this is no longer sustainable drug-selling is completely concentrated in the city, with lower prices and higher seller density.

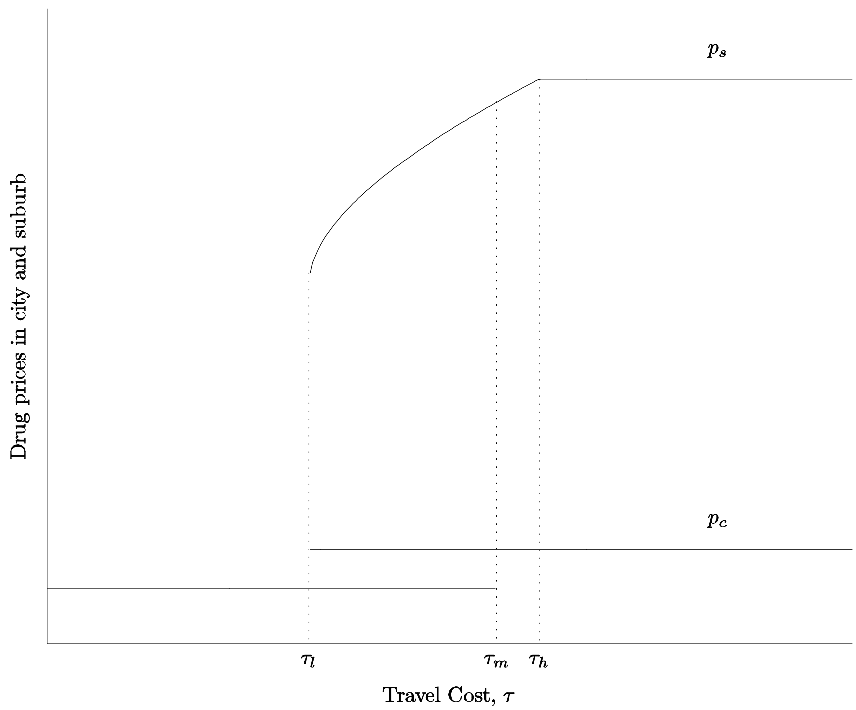

Figure 2. Suburban and city drug prices as a function of τ.

While Figures 1-2 illustrate the effects of changes in τ, the comparative advantage of the city can also be affected by changes in demand density, wages and fixed costs. We show next that when (user and non-user) households are mobile, they sort themselves across neighborhoods in such a manner as to further increase the city's advantage, and hence stabilize allocations in which sales are concentrated there.

7 Residential Mobility

We have assumed to this point that the populations of the city and suburb are exogenously given, and that drug demand per capita is the same in both. If fact, there are several dimensions on the basis of which individuals might choose their location, and these choices will be sensitive to the geographic distribution of drug activity. First and foremost, those who are not themselves users will prefer locations in which street drug selling is absent or rare. Second, the more affluent will outbid poorer households in securing the most desirable locations. And third, when there is racial inequality in the distribution of income, even moderate preferences over neighborhood racial composition can set in motion a process of segregation in residential patterns. We begin with an exploration of sorting by income and race, and turn to the location of drug users in Section 9.

Suppose that the metropolitan population is composed of two groups, black and white, with income distributions $F_b(y)$ and $F_w(y)$ respectively.[12] We assume that at all income levels y,

$$F_b(y) \geq F_w(y), \tag{8}$$

with strict inequality whenever $F_b(y) > 0$ and $F_w(y) < 1$. This reflects the (empirically relevant) assumption that the blacks are less affluent as a group than whites. A share β of the population is black. Drug demand is evenly distributed across the income distribution and by race. We consider the equilibrium sorting of this population across city and suburb, ignoring for the moment the fact that drug users may differ from non-users in their location preferences.

Let γ_i denote the proportion of the total population that neighborhood i can accommodate, which we shall refer to as its *capacity*. Let r_i denote the rent for a housing unit in neighborhood i (or, equivalently, the constant annuity that has the same present value as the purchase price). We normalize $r_c = 0$ and interpret $r_s = r$ as the suburban rent premium.[13]

All income not spent on rent is spent on private consumption. Households care about their level of consumption as well as the characteristics of the neighborhood in which they reside. We focus here on two neighborhood characteristics: racial composition and seller density. A household belonging to group $j \in \{b, w\}$ chooses a location $i \in \{c, s\}$ to maximize

$$u(x) + v_j(\beta_i, \delta_i), \tag{9}$$

where x is private consumption, β_i is the share of black residents in neighborhood i, and δ_i is the distance between sellers in neighborhood i.[14] We refer to δ_i as the inter-seller distance, and its reciprocal as the seller density. We assume that $u(x)$ is increasing and strictly concave and that $v_j(\beta_i, \delta_i)$ is strictly increasing in δ_i (and hence decreasing in seller density) for each $j \in \{b, w\}$. This latter assumption reflects the fact that visible drug dealing is an undesirable neighborhood characteristic. Hence if there were no rent differential and the racial composition of the two neighborhoods were identical, all households would prefer to live in the neighborhood with lower seller density.

Preferences over neighborhood racial composition may be non-monotonic, reflecting a taste for diversity, but we require that any given increase in β_i be valued more highly by black relative to white households. Specifically, we assume that for any β, β' satisfying $\beta' \geq \beta$, and any δ and δ',

$$v_b(\beta', \delta') - v_b(\beta, \delta) \geq v_w(\beta', \delta') - v_w(\beta, \delta), \tag{10}$$

[12] A more complete model would include firms as well as individuals. Firms have no group identity although they may have racial preferences. Many of them are likely to have a strong aversion to the presence of street vice. This aversion could lead to a reduction in business activity in African-American neighborhoods; such a reduction is liable to increase the wage gap in much the same manner as household sorting on the basis of income.

[13] It is important to note that r is the suburban rent premium per housing unit, and not per unit land area. Since population density is lower in the suburb, suburban dwellings are of greater size. Hence $r > 0$ is consistent with a higher price of land in the city, as long as individual housing units cost more in the suburb.

[14] This specification allows for the possibility (but does not require) that $v^b(\beta_i, \delta_i) = v^w(1 - \beta_i, \delta_i)$, which would correspond to symmetric preferences over neighborhood racial composition among blacks and whites.

with strict inequality when $\beta' > \beta$. This is a very weak requirement, fully consistent with strong tastes for diversity as well as the available survey evidence (Sethi and Somanathan, 2004).

Following Sethi and Somanathan (2004), we say that an allocation of households across neighborhoods is *intraracially stratified* (IRS) if there exist income thresholds $\tilde{y}_b$ and $\tilde{y}_w$ such that all households above the threshold for their respective group live in one neighborhood, while all those below live in the other. Intraracially stratified allocations are consistent with a broad range of allocations, from sorting by income alone (if $\tilde{y}_b = \tilde{y}_w$) to extreme racial segregation (if $\tilde{y}_j$ is the highest income in the support of $F_j(y)$ for some group j).

At any IRS allocation the capacity constraint for each neighborhood must be satisfied as follows

$$\beta F_b(\tilde{y}_b) + (1-\beta) F_w(\tilde{y}_w) = \gamma_c. \tag{11}$$

If (11) holds, then the corresponding capacity constraint for the suburb is necessarily satisfied. Finally, define the *marginal bid rent* $r_j(y)$ for a group j individual with income y as the solution to

$$u(y) + v_j(\beta_c, \delta_c) = u(y-r) + v_j(\beta_s, \delta_s).$$

This is the individual's maximum willingness to pay to live in the suburb, and could be positive or negative.

An equilibrium is an allocation of households across neighborhoods and a level of suburban rent such that no household wishes to move to a different location. In any group that is represented in both neighborhoods at an equilibrium, there must be an individual who is indifferent between the two neighborhoods at the prevailing rent. Furthermore, at least one group must be present in both neighborhoods in equilibrium, except in the (non-generic) case where the population shares of the two groups exactly match the capacities of the two neighborhoods. Given our assumptions, the following holds:

Proposition 3. *All equilibrium allocations are intraracially stratified, and $r \neq 0$ in equilibrium.*

Although $r < 0$ is theoretically possible, we focus here on the case $r > 0$. In this case all households below the threshold corresponding to their respective group must reside in the city, and we may define an IRS equilibrium as a triple $(\tilde{y}_b, \tilde{y}_w, r)$ such that

$$u(y) + v_j(\beta_c, \delta_c) \geq u(y-r) + v_j(\beta_s, \delta_s) \tag{12}$$

if and only if $j = b$ and $y \leq \tilde{y}_b$ or $j = w$ and $y \leq \tilde{y}_w$.

Corresponding to any IRS allocation $(\tilde{y}_b, \tilde{y}_w)$ is a unique pair of racial compositions (β_c, β_s), where $\beta_c \gamma_c = \beta F_b(\tilde{y}_b)$ and $\beta_s \gamma_s = \beta (1 - F_b(\tilde{y}_b))$. The mean neighborhood incomes $(\bar{y}_c, \bar{y}_s)$ are then given by:

$$\bar{y}_c = \frac{\beta_c}{F(\tilde{y}_b)} \int_0^{\tilde{y}_b} y f_b(y) dy + \frac{1-\beta_c}{F(\tilde{y}_w)} \int_0^{\tilde{y}_w} y f_w(y) dy, \tag{13}$$

$$\bar{y}_s = \frac{\beta_s}{1-F(\tilde{y}_b)} \int_{\tilde{y}_b}^{\infty} y f_b(y) dy + \frac{1-\beta_s}{1-F(\tilde{y}_w)} \int_{\tilde{y}_w}^{\infty} y f_w(y) dy. \tag{14}$$

We assume that neighborhood wages w_c and w_s are strictly increasing in the respective mean incomes $\bar{y}_c$ and $\bar{y}_s$. Hence the greater the extent of sorting by income in location choices, the greater the wage disparity across neighborhoods.

As a benchmark, consider the case of pure sorting by income and let β_i^* denote the share of the black population in neighborhood i at this allocation. Let y^* denote the threshold (common to both groups) above which households select the suburban location under pure income sorting. Then an immediate consequence of (8) is

$$\beta_c^* > \beta > \beta_s^*. \tag{15}$$

The city has a (proportionally) larger black population than the suburb under pure sorting by income, reflecting the fact that blacks are less affluent than whites as a group. However, as we show below, pure sorting by income can never be an equilibrium.

Define $\hat{y}_b$ as follows

$$\frac{F_b(\hat{y}_b)}{1 - F_b(\hat{y}_b)} = \frac{\gamma_c}{\gamma_s},$$

and let $\hat{y}_w$ denote the unique value of $\tilde{y}_w$ that solves (11) when $\tilde{y}_b = \hat{y}_b$. Then, at the allocation $(\hat{y}_b, \hat{y}_w)$, both neighborhoods have the same racial composition: $\beta_c = \beta_s = \beta$. Note that $\hat{y}_b < \hat{y}_w$ from (8) and hence $\hat{y}_b < y^* < \hat{y}_w$, where y^* is the income threshold (common to both groups) at the allocation with pure income sorting. From (15) it follows that for all allocations $(\tilde{y}_b, \tilde{y}_w) \in [\hat{y}_b, y^*] \times [y^*, \hat{y}_w]$, we have $\beta_c \geq \beta \geq \beta_s$.

At any allocation $(\tilde{y}_b, \tilde{y}_w) \in [\hat{y}_b, y^*] \times [y^*, \hat{y}_w]$ the marginal bid rents $r_j(\tilde{y}_j)$ must (by definition) satisfy

$$u(\tilde{y}_j) + v_j(\beta_c, \delta_c) = u(\tilde{y}_j - r_j(\tilde{y}_j)) + v_j(\beta_s, \delta_s)$$

for each $j \in \{b, w\}$. We assume that the taste for diversity among whites is not so strong as to overwhelm their distaste for proximity to drug-selling in the sense that if $\delta_c < \delta_s$, then

$$v_w(\beta_c, \delta_c) < v_w(\beta_s, \delta_s) \tag{16}$$

for all allocations $(\tilde{y}_b, \tilde{y}_w) \in [\hat{y}_b, y^*] \times [y^*, \hat{y}_w]$. This condition ensures that the white marginal bid-rent $r_w(\tilde{y}_w)$ is positive at all allocations $(\tilde{y}_b, \tilde{y}_w) \in [\hat{y}_b, y^*] \times [y^*, \hat{y}_w]$, which in turn is sufficient to guarantee existence of an equilibrium with a positive suburban rent premium. Our main result is the following.

Proposition 4. *Suppose that $\delta_c < \delta_s$. Then there exists an equilibrium $(\tilde{y}_b, \tilde{y}_w, r)$ such that $r > 0$, $\tilde{y}_b > y^* > \tilde{y}_w$, $w_c < w_s$, and $\beta_c > \beta_c^*$. There is no equilibrium with $\beta_c \in [\beta, \beta_c^*]$.*

This result states that if the city has greater seller density, then there exists an equilibrium in which the proportion of black residents in the city is greater than that which would arise under pure sorting by income. At any such equilibrium, black exposure to high seller density is greater than could be predicted simply on the basis of racial income differences. Furthermore, the city has lower mean income (and hence lower wages) than the suburb at any such equilibrium.

Putting together Propositions 1-4, we see that higher seller density, lower wages, and a disproportionate presence of black households in the city are all mutually reinforcing. Lower wages attract sellers, sellers drive out affluent households who are disproportionately white, and the resulting change in racial composition drives out some lower income whites, further increasing the racial imbalance between city and suburb. This pattern is further stabilized when users are themselves mobile, as we show in Section 9. First, however, we explore the relationship between segregation and racial disparities in exposure.

8 Segregation and Exposure

Define the *exposure* of an individual to vice as the seller density in the neighborhood in which he resides, and the exposure of a group is the average exposure across all its members. Proposition 4 identifies the existence of an equilibrium in which the black population is more exposed than would be the case under pure sorting by income. We now explore the manner in which exposure of blacks and whites varies with the level of equilibrium segregation, and show that this relationship can be non-monotonic and discontinuous, with lower segregation resulting in greater black exposure.

Corresponding to any equilibrium in which $\beta_c > \beta_c^*$, the threshold level of income $\tilde{y}_w$ of the marginal white household must satisfy

$$y_w^{\min} \leq \tilde{y}_w < y^*,$$

where $y_w^{\min}$ satisfies

$$\beta + (1-\beta)\, F_w(y_w^{\min}) = \gamma_c.$$

When $\tilde{y}_w = y_w^{\min}$, all black households live in the city and segregation is at its maximal level. As $\tilde{y}_w$ approaches y^*, segregation declines to zero as the economy approaches pure income sorting. Let $\eta \in [0,1]$ denote the level of integration corresponding to any equilibrium threshold $\tilde{y}_w$, defined by

$$\tilde{y}_w = (1-\eta)\, y_w^{\min} + \eta y^*.$$

Given $\tilde{y}_w(\eta)$, the corresponding black threshold $\tilde{y}_b(\eta) > y^*$ is simply determined by the capacity constraints for the two neighborhoods. The mean incomes in the two neighborhoods $\bar{y}_c$ and $\bar{y}_s$ are given by (13-14) and may also be expressed as functions of η. Note that $\bar{y}_c(\eta)$ is decreasing: greater integration implies more income sorting and lower income levels in the less affluent neighborhood. For the same reason, $\bar{y}_s(\eta)$ is increasing. Since neighborhood wages vary monotonically with mean incomes, we may write $w_c(\eta)$ and $w_s(\eta)$; the former function is decreasing and the latter increasing.

Changes in integration therefore affect income distributions and hence local wages, which in turn affect the location decisions of firms. Of particular interest is the case in which such changes can induce a discontinuous shift in location patterns that dramatically alters racial disparities in exposure. A sufficient condition for this to happen is that the autarky equilibrium is replicated under complete segregation ($\eta = 0$), while only the agglomeration equilibrium exists under complete integration ($\eta = 1$). The following two conditions ensure that this is the case:

$$\begin{aligned} w_s(0) - w_c(0) &< \tau - \frac{1}{4}\sqrt{Ct}\left(6\sqrt{1/\rho_s} - 5\sqrt{1/\rho_c}\right) \\ w_s(1) - w_c(1) &> \tau - \frac{1}{4}\sqrt{Ct}\left(4\sqrt{2/\rho_s} + 5\sqrt{1/\rho_c}\right) \end{aligned}$$

If these conditions hold, then it must be the case that exposure varies non-monotonically and discontinuously with integration, with a sharp rise in black exposure at the point of discontinuity. This is illustrated for a particular numerical specification of the model in Figure 3.

Hence integration, which results in greater suburban black representation, can also result in *increases* in overall black exposure. This is because the suburb becomes more affluent relative to the city as integration rises, and the resulting changes in local wages can cause drug sales to shift to the city. The suburban population that benefits from this is disproportionately white, while the population that becomes more exposed is disproportionately black. Note however, that greater integration on either side of the threshold has the effect of reducing the exposure to drug sales of black households.

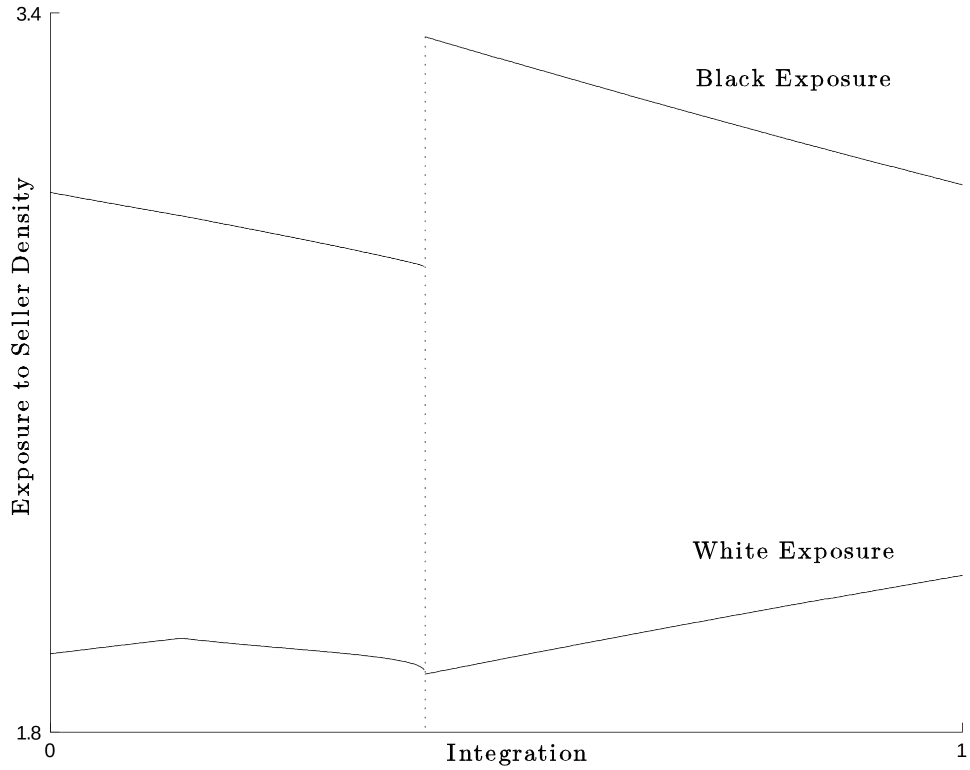

Figure 3. Segregation and Exposure

Has integration in fact exposed the average African-American to more street vice? Some work in sociology argues that it has. In particular, Wilson (1987, 1996) contrasts the safety and civility of pre-integration African-American neighborhoods with the criminality and disorganization he finds in these neighborhoods after 1970 or so. He attributes this deterioration to middle class exit. "Blacks in Harlem and in other ghetto neighborhoods did not hesitate to sleep in parks, on fire escapes, and on rooftops during hot summer nights in the 1940s and 1950s," he writes, but he finds that these neighborhoods no longer exhibit "the features of social organization" (1987, p. 3). Of Woodlawn in Chicago, Wilson (1996, p. 5) quotes approvingly from Loic Wacquant: "The once-lively streets–residents remember a time, not so long ago, when crowds were so dense at rush hour that one had to elbow one's way to the train station–now have the appearance of an empty bombed out war zone."

For Wilson, the process that brought about these changes is "social isolation" and "concentration effects" (1987, pp. 58, 60): children have fewer role models, job-seekers have more restricted networks, and social institutions function less effectively. Our model has the same general predictions, but the mechanism is different. It is also arguably more plausible for two reasons. First, it is more direct: street vice is what makes these neighborhoods unsafe and disorganized. Second, the amount of residential integration that occurred during the time when neighborhoods deteriorated is small, and the processes on which Wilson relies should require a lot of time. To consider the two cities in Wilson's examples: the index of black-white dissimilarity for metropolitan Chicago fell only from 91.9 in 1970 to 85.8 in 1990; for metropolitan New York the index of dissimilarity actually rose during this period, from 81.0 in 1970 to 82.2 in 1990 (Massey and Denton, 1993, table 8.1, page 222).[15] A process with discontinuities like ours seems more appropriate.

Of course, we do not pretend that our model explains all the changes that have taken place in African-American neighborhoods in the past half century. Rising wage inequality, for instance, has probably mattered, as has the growth of African-American social and civil liberty in the South. The war on drugs, by raising the fixed costs of drug-selling, may also have concentrated street vice geographically. Our model provides some insight into the reasons why the quality of life may have deteriorated in these neighborhoods.

9 The Location of Drug Users

Drug users have many of the same concerns as non-users with respect to their choices, but additionally may seek to minimize costs of securing drugs. We assume that when choosing their neighborhood, users do not know precisely where sellers will locate, but do know prices and the distances between firms. The expected drug procurement costs conditional on locating in the city is

$$\theta_c = p_c + \frac{1}{4}t\delta_c,$$

since there is always at least one firm is located there. The cost of drug procurement in the suburb depends on whether or not there are any firms located there:

$$\theta_s = \begin{cases} p_s + \frac{1}{4}t\delta_s & \text{if } n_s > 0 \\ p_c + \tau + \frac{1}{4}t\delta_c & \text{if } n_s = 0 \end{cases}$$

As is the case with non-users, drug users choose locations to maximize (9). However their private consumption x is $y - \theta_c$ if they locate in the city and $y - r - \theta_s$ if they locate in the suburb. Note that if $p_c < p_s$ and $\delta_c < \delta_c$, then it follows that $\theta_c < \theta_s$. Hence the effective rent premium paid by users to live in the suburb is greater than the rent premium paid by non-users. Additionally, users have lower residual income to spend on (non-drug) consumption relative to non-users with the same income. Both these effects will induce some users to locate in the city even if non-users with comparable incomes do not. This is stated more formally below.

An intraracially stratified allocation with user mobility is characterized by four thresholds: $\tilde{y}_b$ and $\tilde{y}_w$ for non-users, and $\tilde{y}_{bd}$ and $\tilde{y}_{wd}$ for drug users. An equilibrium is then a 5-tuple $(\tilde{y}_b, \tilde{y}_w, \tilde{y}_{bd}, \tilde{y}_{wd}, r)$ satisfying

$$u(y) + v_j(\beta_c, \delta_c) \geq u(y - r) + v_j(\beta_s, \delta_s) \tag{17}$$

[15] Cutler, Glaeser and Vigdor (1999) find a considerable national decline in segregation during this period (16.7 percent) but this decline is primarily outside the older industrial cities of the Northeast and Midwest that Wilson is most concerned with.

if and only if $j = b$ and $y \leq \tilde{y}_b$ or $j = w$ and $y \leq \tilde{y}_w$ for non-users, and

$$u(y - \theta_c) + v_j(\beta_c, \delta_c) \geq u(y - r - \theta_s) + v_j(\beta_s, \delta_s) \tag{18}$$

if and only if $j = b$ and $y \leq \tilde{y}_{bd}$ or $j = w$ and $y \leq \tilde{y}_{wd}$ for users.

Let d denote the proportion of users in the metropolitan population, and d_i the proportion of residents of neighborhood $i \in \{c, s\}$ who are users. Then the capacity constraint (11) becomes

$$(1 - d)\left(\beta F_b(\tilde{y}_b) + (1 - \beta) F_w(\tilde{y}_w)\right) + d\left(\beta F_b(\tilde{y}_{bd}) + (1 - \beta) F_w(\tilde{y}_{wd})\right) = \gamma_c \tag{19}$$

As before, if this is satisfied, then so is the capacity constraint for the suburb. The proportion of residents who are users in city and suburb are, respectively,

$$\begin{aligned} d_c &= \frac{d\left(\beta F_b(\tilde{y}_{bd}) + (1 - \beta) F_w(\tilde{y}_{wd})\right)}{\gamma_c} \\ d_s &= \frac{d\left(\beta\left(1 - F_b(\tilde{y}_{bd})\right) + (1 - \beta)\left(1 - F_w(\tilde{y}_{wd})\right)\right)}{\gamma_s} \end{aligned} \tag{20}$$

The following result shows that drug users remain in the city at higher incomes than non-users in the same social group, and that per-capita drug demand is therefore higher in the city.

Proposition 5. *Suppose that $p_c < p_s$ and $\delta_c < \delta_c$. Then, at any equilibrium with $r > 0$, we have $\tilde{y}_{jd} > \tilde{y}_j$ for each $j \in \{b, w\}$, and hence $d_c > d_s$.*

Drug users are disproportionately located in the city (relative to non-users with comparable income) for two reasons. First, this lowers their costs of drug procurement, since $\theta_c < \theta_s$. Second, since users spend money on drugs they have less to spend on other consumption, lowering their marginal bid rent to live in the suburb. They are effectively less affluent than their income suggests. These two effects imply that $d_c > d_s$ (the proportion of users per unit population will be greater in the city than the suburb). Since population density is itself greater in the city, this implies greater demand density per unit distance in the city relative to the suburb. The qualitative analysis in Section 5-6 therefore remains intact. Greater drug demand per unit distance in the city further strengths its comparative advantage relative to the suburb and makes complete specialization more likely.

As long as the proportion d of users in the overall population is sufficiently small, any equilibrium of the general model with sorting by users and non-users will be close to an equilibrium with only non-user sorting in the following sense: the thresholds $\tilde{y}_b$ and $\tilde{y}_w$ under full sorting will approach the corresponding thresholds under non-user sorting as d approaches zero. This means that the racial disparities identified in Proposition 4 hold also in the more general case of full sorting as long as the user population is small. Furthermore, these disparities arise among both users and nonusers: the threshold at which white users move to the suburbs is lower than that at which black users move. The result is segregation (in excess of that which would arise under pure income sorting) in both user and non-user populations.

The greater concentration of users in the city has the effect of further increasing seller density there. This makes the city more attractive to drug users and less attractive to non-users. The former move in and the latter move out; concentration begets concentration. Non-users move to the suburbs either because the rent premium is lower or because the distance between drug firms is higher (relative to the case when users are immobile). And those (users and non-users) who live in the proximity of street vice are disproportionately black, not only because of racial inequality in the distribution of income, but also because there is a range of middle income levels within which blacks remain in the exposed population while whites locate elsewhere.

10 Empirical Implications

Since drug sale and consumption are illegal, they are not well reported. As a result there is little reliable data on actual consumption and sale of drugs, especially on a fine geographical basis. We do have information, however, about phenomena that are plausibly correlated with drug use and sales, such as drug arrests, overdoses and emergency room incidents, and murders. Any presumed correlation, of course, deserves to be treated with skepticism.

10.1 Arrests

The model implies that drug trafficking arrests should be concentrated in black neighborhoods. This is especially true in metropolitan areas where the agglomeration regime prevails and the anonymous drug market has collapsed in the suburbs. Even when there is no trade, firms are closer together in cities. This makes them easier for the police to find, and one would expect arrests to be concentrated where they are easier to make.

Notice that this implication is about where arrests are made, not who is arrested. The model does imply that blacks are more likely to be arrested for drug trafficking under most conditions, but does not carry a strong implication for consumption arrests, since rates of drug consumption are assumed to be the same across groups. The model implies that the concentration of drug arrests in black neighborhoods should be at least as great as the concentration of drug arrests on black persons in all metropolitan areas, and much greater in some.

The model also implies that drug selling is more concentrated in central cities when τ (the cost to someone of going from suburb to city to buy drugs) is smaller. *Ceteris paribus*, we should expect that in metropolitan areas where the black population is more centralized or inhabits a relatively larger area the proportion of drug arrests made in black neighborhoods will be higher.

Wages also matter. The greater the black-white wage gap in the legitimate market, the greater the concentration of drug arrests in the black neighborhood. Of course, our model assumes just one wage in each neighborhood and so does not encompass the actual distribution of wages. The relevant difference is between the wages that black and white drug dealers could earn. Thus something like the difference between high school drop-out wages would be a better measure than the unconditional wage gap. The greater the racial gap in the wage for unskilled labor, the greater the concentration of drug arrests in black neighborhoods.

10.2 Overdoses and Emergency room incidents

Arrests depend on police initiatives, and nothing guarantees that police everywhere will be equally aggressive in enforcing drug laws. Overdoses and emergency room incidents, on the other hand, are largely involuntary, given the volume of drug consumption. Therefore, a number of researchers have used them as proxies for drug consumption (see, for instance, Mocan and Corman, 2000). For our purposes they have the added advantage of being localized: a person suffering an overdose or other medical emergency is highly likely to be brought to the nearest emergency room.

On the other hand, overdoses and emergency room incidents are indicators of consumption, not sale, unless people consume drugs close to where they purchase them. This would reduce the concentration of these incidents. But increasing returns to scale and specialization play important roles in the delivery of emergency medical services, quite apart from the organization of the drug market. This would increase concentration.

If these centripetal and centrifugal forces are randomly present in metropolitan areas, then metropolitan areas with more centralized black populations, larger black neighborhoods, and a larger racial wage gap for unskilled men should also see a greater concentration of overdoses and emergency room incidents.

10.3 Murders

People in the drug-selling business are much more likely to kill and be killed than people in most other businesses. Legal means of dispute resolution are not available to the drug business and so violence is often used to settle disputes; the threat of violence is used to deter attacks and disputes. Criminal penalties for murder are also lower: the marginal cost of a conviction for murder is less for somebody who faces a high probability of a 20-year sentence for drug trafficking than it is for someone with no other prospect of legal trouble. Judges and prosecutors may also tend to be less harsh in sentencing people who have murdered drug dealers, than in sentencing those whose victims are more sympathetic. Thus places with more drug-dealing should be places with more murder.

Thus, the fact that murders are concentrated in black neighborhoods is consistent with this paper's model. In New Jersey, for instance, eleven older, heavily black municipalities in 2003 accounted for 14.5% of the state's population but 61.8% of its murders (New Jersey State Police, 2004). In New York, the 31 NYPD precincts located in community districts that were either majority black, majority Hispanic or more than 75% black and Hispanic saw 49.8% of all murders in the state in 2001. These community districts accounted for 17.2% of the state's total population. If we look only at community districts that are majority African-American, which comprised 7.5% of state population, we find that the precincts in these community districts reported 24.5% of the state's murders.

Hence we should expect to find greater concentrations of murder in metropolitan areas with more centralized black populations, large areas of black neighborhoods, and greater inter-racial wage gaps.

11 Conclusion

We have presented a simple model that predicts that drug-selling will be concentrated in black neighborhoods of central cities. This effect arises through the interacting location choices of sellers and (user and non-user) households. Areas with greater population density tend to have more densely packed sellers and lower prices, which causes some non-users to depart selectively. As the wealthier households leave, the remaining population becomes disproportionately black (due to racial inequality in the metropolitan income distribution). This induces lower income whites to leave, heightening segregation. Users move in (although white and black users do so at different rates), which further increases demand density and hence seller density. These effects are mutually reinforcing, resulting in a centralized area with large concentrations of sellers, users, black households of varying income levels, and the lowest income whites. Somewhat paradoxically, the movement of black households to less exposed locations can result in an increase in overall black exposure. This possibility arises because greater integration widens income and wage disparities between city and suburb, inducing suburban sellers to move to the city, where a disproportionate share of the black population resides.

The model relies on minimal assumptions about how black households differ from white households. Demand density is assumed to be independent of income and race, and preferences over neighborhood racial composition may be consistent with strong tastes for diversity in both groups. The only substantive difference between blacks and whites lies in the distribution of income. Nevertheless, the model generates a number of important implications for racial differences in location, occupation, arrest and incarceration. These results arise not from the pharmacological properties of illicit drugs, except for inelastic demand, but from the fact that they are illegal. Thus they probably apply to other kinds of anonymous vice such as gambling and prostitution. The legalization of such activities would undoubtedly affect their distribution across space, the consequences of exposure to them, and the disparities in such exposure across income and identity groups.

Appendix

Proof of Proposition 2. The suburban consumers for whom drugs are most expensive under autarky are those located midway between two firms. Using (5) and (3) such consumers pay

$$w_s + t\sqrt{A_s} + \frac{1}{2}t\delta_s = w_s + \frac{3}{2}t\sqrt{A_s}$$

under autarky. Hence, using (7), the autarky equilibrium will be replicated provided that

$$\tau \geq w_s - w_c + \frac{1}{4}\left(6t\sqrt{A_s} - 5t\sqrt{A_c}\right) = \tau_h. \tag{21}$$

Next consider values of τ below τ_h, and suppose that prices and seller density in the city remain at autarky levels, while suburban prices and seller density satisfy

$$p_s = \pi_{aut} - \frac{1}{2}t\delta_s, \tag{22}$$

where π_{aut} is given by (7). In this case the marginal consumer is indifferent among the two adjacent suburban firms and journeying to the city. The zero profit condition for suburban firms is

$$(p_s - w_s)\,\rho_s\delta_s - C = 0. \tag{23}$$

Solving (22-23) yields after some simplification:

$$\begin{aligned} p_s &= \frac{1}{2}\left(\pi_{aut} + w_s + \sqrt{(\pi_{aut} - w_s)^2 - 2A_s t^2}\right), && (24) \\ \delta_s &= \frac{1}{t}\left(\pi_{aut} - w_s - \sqrt{(\pi_{aut} - w_s)^2 - 2A_s t^2}\right), && (25) \end{aligned}$$

A necessary and sufficient condition for an equilibrium of this type to exist is that the expression under the square root be non-negative. This simplifies to $\pi_{aut} \geq w_s + t\sqrt{2A_s}$ or, using (7),

$$\tau \geq w_s - w_c + t\sqrt{2A_s} - \frac{5}{4}t\sqrt{A_c} \equiv \tau_l \tag{26}$$

It is easily seen that $\tau_l < \tau_h$ since $\sqrt{2} < \frac{3}{2}$.

If $\tau < \tau_l$, suburban drug markets are no longer sustainable and all consumers, regardless of residential location, shop in the city. The change at $\tau = \tau_l$ is discontinuous: the number of suburban firms falls from

$$n_s = \frac{L_s}{\sqrt{2A_s}}$$

to zero; and the quantity of drugs sold in the suburb drops from $L_s\rho_s$ to zero. The response in the city is a discontinuous increase in demand density from ρ_c to

$$\rho_c' = \rho_c + \frac{L_s}{L_c}\rho_s.$$

Define A_c' as follows:

$$A_c' = \frac{C}{t\rho_c'},$$

and note that $A_c' < A_c$. Using the same reasoning as in the derivation of (3-5), we obtain the following values for the price, number of firms, and inter-firm distance at this equilibrium:

$$\begin{aligned} p_c' &= w_c + t\sqrt{A_c'}, \\ n_c' &= \frac{L_c}{\sqrt{A_c'}}, \\ \delta_c' &= \sqrt{A_c'}. \end{aligned}$$

Since $A_c' < A_c$, the city has lower prices and greater seller density relative to autarky.

To complete the proof, we need to show that the latter (agglomeration) equilibrium also exists for all $\tau \in (\tau_l, \tau_m)$ for some $\tau_m > \tau_l$. Define

$$\pi_{agg} = w_c + \tau + \frac{5}{4}t\sqrt{A_c'}, \tag{27}$$

and note that $\pi_{agg} < \pi_{aut}$. Replace π_{aut} with π_{agg} in (24-25) to get

$$\begin{aligned} p_s &= \frac{1}{2}\left(\pi_{agg} + w_s + \sqrt{(\pi_{agg} - w_s)^2 - 2A_s t^2}\right), \\ \delta_s &= \frac{1}{t}\left(\pi_{agg} - w_s - \sqrt{(\pi_{agg} - w_s)^2 - 2A_s t^2}\right). \end{aligned}$$

The expression under the square root is non-negative if and only if $\pi_{agg} \geq w_s + t\sqrt{2A_s}$ or, using (27),

$$\tau \geq w_s - w_c + t\sqrt{2A_s} - \frac{5}{4}t\sqrt{A_c'} \equiv \tau_m$$

It is easily seen that $\tau_m > \tau_l$ since $A_c' < A_c$. ■

Proof of Proposition 3. First we prove that $r \neq 0$ in equilibrium. If $r = 0$, then either all individuals in any given group strictly prefer one neighborhood to the other (which violates the capacity constraints), or

$$v_b(\beta_c, \delta_c) - v_b(\beta_s, \delta_s) = v_w(\beta_c, \delta_c) - v_w(\beta_s, \delta_s) = 0, \tag{28}$$

which contradicts (10), unless $\beta_c = \beta_s = \beta$. But if $\beta_c = \beta_s = \beta$ then $v_j(\beta_c, \delta_c) < v_j(\beta_s, \delta_s)$ for each $j \in \{b, w\}$, so (28) cannot hold. Hence $r \neq 0$ in equilibrium.

Next, we show that all equilibrium allocations are intraracially stratified. Consider any group j which is present in both locations. Then there must be some income y such that

$$u(y) + v_j(\beta_c, \delta_c) = u(y - r) + v_j(\beta_s, \delta_s),$$

otherwise all members of group j would strictly prefer one neighborhood to the other. Concavity of u then implies intraracial stratification. If $r > 0$ then those with incomes above the threshold for the group to which they belong live in the suburb, and if $r < 0$ then those with incomes above the threshold for the group to which they belong live in the city. Hence all equilibrium allocations are intraracially stratified. ■

Proof of Proposition 4. Consider any allocation $(\tilde{y}_b, \tilde{y}_w) \in [\hat{y}_b, y^*] \times [y^*, \hat{y}_w]$. Since $\beta_c \geq \beta_s$ at all such allocations, we have

$$v_b(\beta_c, \delta_c) - v_b(\beta_s, \delta_s) \geq v_w(\beta_c, \delta_c) - v_w(\beta_s, \delta_s) \tag{29}$$

from (10). Hence

$$u(\tilde{y}_b) - u(\tilde{y}_b - r_b(\tilde{y}_b)) \leq u(\tilde{y}_w) - u(\tilde{y}_w - r_w(\tilde{y}_w)). \tag{30}$$

Since u is strictly concave and $r_w(\tilde{y}_w) > 0$ from (16), this implies $r_b(\tilde{y}_b) < r_w(\tilde{y}_w)$ whenever $\tilde{y}_b < \tilde{y}_w$, and hence for all $(\tilde{y}_b, \tilde{y}_w) \in [\hat{y}_b, y^*) \times (y^*, \hat{y}_w]$. For the special case $\tilde{y}_b = \tilde{y}_w = y^*$, $\beta_c < \beta_s$ and hence (29) and (30) both hold with strict inequality, which again implies $r_b(\tilde{y}_b) < r_w(\tilde{y}_w)$. Hence there can be no equilibrium at any allocation $(\tilde{y}_b, \tilde{y}_w) \in [\hat{y}_b, y^*] \times [y^*, \hat{y}_w]$, and therefore none with $\beta_c \in [\beta, \beta_c^*]$.

To prove that there exists an equilibrium with $\beta_c > \beta_c^*$, let $\bar{y}_b$ denote the upper bound of the support of $F_b(y)$ and define $\bar{y}_w$ as the unique value of $\tilde{y}_w$ that satisfies (11) when $\tilde{y}_b = \bar{y}_b$. If $r_b(\bar{y}_b) \leq r_w(\bar{y}_w)$ then there exists an equilibrium with allocation $(\tilde{y}_b, \tilde{y}_w) = (\bar{y}_b, \bar{y}_w)$ and rent $r = r_w(\bar{y}_w) > 0$. At this equilibrium $\beta_c > \beta_c^*$ and $\beta_s = 0$. On the other hand, if $r_b(\bar{y}_b) > r_w(\bar{y}_w)$ then there must be some allocation $(\tilde{y}_b, \tilde{y}_w) \in (y^*, \bar{y}_b) \times (\hat{y}_w, y^*)$ that satisfies (11) and such that $r_b(\tilde{y}_b) = r_w(\tilde{y}_w) > 0$. This follows from the fact that $r_b(y^*) < r_w(y^*)$. Any such allocation $(\tilde{y}_b, \tilde{y}_w)$ is an equilibrium with rent $r = r_b(\tilde{y}_b) = r_w(\tilde{y}_w) > 0$. Furthermore, since $(\tilde{y}_b, \tilde{y}_w) \in (y^*, \bar{y}_b) \times (\hat{y}_w, y^*)$, we have $\beta_c > \beta_c^*$. ∎

Proof of Proposition 5. Consider any equilibrium $(\tilde{y}_b, \tilde{y}_w, \tilde{y}_{bd}, \tilde{y}_{wd}, r)$ with $r > 0$. The indifference condition for the marginal user belonging to group j is then

$$u(\tilde{y}_{jd} - \theta_c) + v_j(\beta_c, \delta_c) = u(\tilde{y}_{jd} - r - \theta_s) + v_j(\beta_s, \delta_s).$$

Comparing this to the indifference condition for the marginal non-user in group j,

$$u(\tilde{y}_j) + v_j(\beta_c, \delta_c) = u(\tilde{y}_j - r) + v_j(\beta_s, \delta_s),$$

we get

$$u(\tilde{y}_{jd} - \theta_c) - u(\tilde{y}_{jd} - r - \theta_s) = u(\tilde{y}_j) - u(\tilde{y}_j - r).$$

Since $\theta_s > \theta_c > 0$,

$$u(\tilde{y}_{jd} - \theta_c) - u(\tilde{y}_{jd} - r - \theta_c) < u(\tilde{y}_j) - u(\tilde{y}_j - r) \tag{31}$$

Suppose $\tilde{y}_{jd} \leq \tilde{y}_j$. Then concavity of u implies

$$u(\tilde{y}_{jd} - \theta_c) - u(\tilde{y}_{jd} - r - \theta_c) > u(\tilde{y}_j) - u(\tilde{y}_j - r),$$

which contradicts (31). Hence $\tilde{y}_{jd} > \tilde{y}_j$ for each $j \in \{b, w\}$, which implies from (19–20),

$$\begin{aligned} d_c &= \frac{d\left(\beta F_b(\tilde{y}_{bd}) + (1-\beta)\, F_w(\tilde{y}_{wd})\right)}{(1-d)\left(\beta F_b(\tilde{y}_b) + (1-\beta)\, F_w(\tilde{y}_w)\right) + d\left(\beta F_b(\tilde{y}_{bd}) + (1-\beta)\, F_w(\tilde{y}_{wd})\right)} \\ &> \frac{d\left(\beta F_b(\tilde{y}_{bd}) + (1-\beta)\, F_w(\tilde{y}_{wd})\right)}{(1-d)\left(\beta F_b(\tilde{y}_{bd}) + (1-\beta)\, F_w(\tilde{y}_{wd})\right) + d\left(\beta F_b(\tilde{y}_{bd}) + (1-\beta)\, F_w(\tilde{y}_{wd})\right)} = d \end{aligned}$$

so $d_c > d > d_s$. ∎

References

[1] Becker, Gary S., Kevin M. Murphy and Michael Grossman, 2006, "The market for illegal goods: The case of drugs," *Journal of Political Economy* 114: 38-60.

[2] Beckett, Katherine, 2004, Race and drug law enforcement in Seattle, Defender's Association "Racial Disparity Project," Seattle. Accessed on August 4, 2008 at www.prisonpolicy.org.scans/Beckett20040503.

[3] Beckett, Katherine, Kris Nyrop, and Lori Pflingst, 2006, Race, drugs and policy: understanding disparities in drug delivery arrests, *Criminology* 44: 105-137.

[4] Bourgois, Pillippe, 1995, *In Search of Respect: Selling Crack in El Barrio*. Cambridge: Cambridge U. Press.

[5] Brueckner, Jan K and Harris Selod, 2008, "A theory of urban squatting and land-tenure formalization in developing countries," *American Economic Journal: Economic Policy*, forthcoming.

[6] Caulkins, JP, B. Johnson, A. Taylor and L. Taylor, 1999, What drug dealers tell us about their costs of doing business, *Journal of Drug Issues* 29: 323-40.

[7] Cork, Daniel, 1999, "Examining space-time interaction in city-level homicide data: Crack markets and the diffusion of guns among youth," *Journal of Quantitative Criminology* 15: 379-406.

[8] Corman, Hope and Naci Mocan, 2000, "A time series analysis of crime, deterrence, and drug abuse in New York City," *American Economic Review* 90: 584-604.

[9] Cutler, David and Edward Glaeser, 1997, "Are ghettoes good or bad?" *Quarterly Journal of Economics* 112: 827-92.

[10] Cutler, David, Edward Glaeser and Jacob Vigdor, 1999, "The rise and decline of the American ghetto, *Journal of Political Economy* 107: 455-506.

[11] Drake, St. Clair, and Horace Cayton, 1945, *Black Metropolis: A Study of Negro Life in a Northern City*. New York: Harcourt Brace and Company. 2nd edition, 1962, New York: Harper and Row.

[12] Echenique, Federico, and Roland G. Fryer, 2007, "A Measure of Segregation Based on Social Interactions," *Quarterly Journal of Economics* 122: 441-485.

[13] Ellen, Ingrid, 2000, "Is segregation bad for your health? The case of low birth weight," *Brookings-Wharton Papers on Urban Affairs* 1, 203-238

[14] Fagan, Jeffrey, 1992, Drug selling and licit income in distressed neighborhoods: The economic lives of street-level drug users and dealers, In *Drugs, Crime, and Social Interaction*, edited by George Peterson and Adele Harrell. Washington, DC: Urban Institute Press.

[15] Fryer, Roland G., Paul S. Heaton, Steven D. Levitt, ad Kevin M. Murphy, 2005, "Measuring the impact of crack cocaine," National Bureau of Economic Research Working Paper 11318.

[16] Goode, Erich, 2002, “Drug arrests at the millennium, *Society* 39: 41-45.

[17] Grogger, Jeff and Mike Willis, 2000, “The introduction of crack cocaine and the rise of urban crime rates,” *Review of Economics and Statistics* 82: 519-29.

[18] Hagedorn, John M, 1998, “The Business of Drug Dealing in Milwankee,” Thiensville, WI: Wisconsin Policy Research Institute.

[19] Hotelling, Harold, 1929, “Stability in competition,” *Economic Journal* 39: 41-57.

[20] Human Rights Watch, 2000, Punishment and Prejudice: Racial Disparities in the War on Drugs. Accessed on August 4, 2008 at http://hrw.org/reports/2000/usa/

[21] Ludwig, Jens and Jeff Kling, 2006, “Is crime contagious?” , Princeton Industrial Relations Section Working Paper 510, at http://www.wws.princeton.edu/~kling/mto/recent.html

[22] King, Ryan S., 2008, “Disparity by Geography: The War on Drugs in America's Cities.” Washington: The Sentencing Project. Accessed on August 4, 2008 at www.sentencingproject.org/PublicationDetails,aspx?PublicationID=614

[23] Levitt Steven D. and Sudhir Venkatesh, 2000, An economic analysis of drug-selling gang's finances, *Quarterly Journal of Economics* 115: 755-89.

[24] Loury, Glenn C., 2007, “Racial Stigma, Mass Incarceration and American Values.” Tanner Lectures in Human Values, Stanford University.

[25] MacDonald, Heather, 2008, Is the Criminal-Justice System Racist? *City Journal* 18(2).

[26] Massey, Douglas S. and Nancy A. Denton, 1993, *American Apartheid: Segregation and the Making of the Underclass*. Cambridge: Harvard University Press.

[27] Mieszkowski, Peter and Edwin S. Mills, 1993, “The Causes of Metropolitan Suburbanizations,” Journal of Economic Perspectives 7: 135-147

[28] Miron, Jeffrey A., 1999, “Violence and U.S. prohibitions on drugs and alcohol,” *American Law and Economics Review* 1: 78-114.

[29] Miron, Jeffrey A., 2001, “Violence, guns, and drugs,” *Journal of Law and Economics* 44: 615-34.

[30] Myrdal, Gunnar, 1944, *American Dilemma: The Negro Problem and Modern Democracy.* New York and London: Harper and Brothers. Reprint, New Brunswick, NJ: Transaction Publishers, 1996.

[31] O'Flaherty, Brendan and Rajiv Sethi, 2007, “Crime and segregation,” *Journal of Economic Behavior and Organization*, 64: 391-405.

[32] O'Flaherty, Brendan and Rajiv Sethi, 2008, “Homicide in Black and White,” Unpublished Manuscript, Columbia University.

[33] Pastore, Ann L. and Kathleen Maguire, eds. Sourcebook of Criminal Justice Statistics [Online].

[34] Persico, Nicola and Petra Todd, 2005, "Using hit rates to test for racial bias in law enforcement," University of Pennsylvania, PIER discussion paper 05-004, http://pier.econ.upenn.edu/Archive/05-004.pdf

[35] Raphael, Steven, and Michael Stoll, 2001, "Can Boosting Minority Car-Ownership Rates Narrow Inter-Racial Employment Gaps?," in William G. Gale and Janet Rothenberg Pack (eds), *The Brookings-Wharton Papers on Urban Economic Affairs*, Volume 2, The Brookings Institution: Washington, DC: pp 99-145.

[36] Reuter, Peter, Robert MacCoun and Patrick Murphy, 1990, Money from Crime: A Study of the Economics of Drug Dealing in Washington, DC (R-3894-RF). Santa Monica: Rand.

[37] Reuter, Peter and Robert MacCoun, 1992, Are the Wages of sin $30 an hour? Economic aspects of street-level drug dealing. *Crime and Delinquency* 38: 477-91.

[38] Salop, Steven C. , 1979, "Monopolistic competition with outside goods," *Bell Journal of Economics*, 10: 145-156.

[39] Schelling, Thomas C. (1971). "Dynamic Models of Segregation." *Journal of Mathematical Sociology* 1: 143–86.

[40] Sethi, Rajiv and Rohini Somanathan, 2004, "Inequality and Segregation," *Journal of Political Economy* 112: 1296-1321.

[41] Sourcebook of Criminal Justice Statistics, 2007, http://www.albany.edu/sourcebook/index.html

[42] Stinchcombe, Arthur, 1963, "Institutions of privacy in the determination of police administrative practices." *American Journal of Sociology* 69:150-60.

[43] Tirole, Jean, 1989, *Theory of Industrial Organization*. Cambridge, MA: MIT Press.

[44] Tonry, Michael, 1995, *Malign Neglect: Race, Crime and Punishment in America*. Oxford: Oxford University Press.

[45] Turnbull, G., 2008, Squatting, eviction and development, *Regional Science and Urban Economics* 38:1-15.

[46] Verdier, Thierry and Yves Zenou, 2004, Racial beliefs, location, and the causes of crime, *International Economic Review* 45:731-60.

[47] Washington, Booker T., 1915, "My view of segregation laws," *The New Republic*, December 4; in *Collected Papers*, vol. 13, 357-60.

[48] Wilson, William J., 1987, *The Truly Disadvantaged: The Innner City, the Underclass, and Public Policy*. Chicago: University of Chicago Press.

[49] Wilson, William J., 1996, *When Work Disappears: The World of New Urban Poor*. New York: Knopf.